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Science

Level 1/2 Cambridge National Certificate in Science in the Workplace **J816**

OCR Report to Centres January 2015

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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OCR REPORT TO CENTRES

R075/01 How scientific data is used (Level 1)

General Comments:

This examination provides candidates with opportunities to demonstrate their knowledge and understanding of the ways scientists obtain, analyse and communicate information using the context of the analytical techniques they have experienced in unit R704.

It was clear that Centres had appropriately entered candidates who were suited to the structured approach of this Level 1 paper. Candidates were able to demonstrate their knowledge and understanding well on structured questions (e.g. questions 1ai, 1aii and 3a). The language used in questions was appropriate and there was no evidence that candidates did not have sufficient time to complete the examination as all questions were attempted on the majority of papers. However, candidates need to ensure that they spend sufficient time reading questions carefully so that their answers address all aspects of the question, particularly in extended writing tasks where keywords relating to required answers were highlighted in bold type (e.g. questions 2a and 4d).

Candidates should appreciate that the use of data is a key aspect of this course and that the quality of the data should be assessed before it is used in calculations. As well as recognising outliers and relating this to reliability candidates need to understand that outliers are excluded from all aspects of data processing (e.g. question 4d). Candidates subsequently need to further develop the ability to use both results and processed data to make conclusions, including reference to their levels of certainty.

Where experimental methods are described candidates need a better understanding of the relevant terms in the specification, fair testing and accuracy were often confused with reliability (e.g. questions1b, 4bii).

Comments on Individual Questions:

Question No.1

Part (a) was well answered, most candidates knowing the required flame test colour. However in part (b) many did not appreciate that a second testing technique is used to confirm findings and confused this with accuracy.

Parts (c) and (e) indicated that although candidates were familiar with the experimental method of mass spectrometry many lacked awareness of how the experimental results are interpreted. There was confusion between the results shown in the intensity graph and the atomic mass reference table used to interpret the graph. In part (ci) it was apparent that many candidates used the fact that the table identified Cu with the highest atomic mass as the reason Cu was present rather than a clear reference to the fact that the graph has the highest intensity line at 63. This was evident in part (cii) where calcium was commonly wrongly identified with potassium as a metal in the waste, presumably as these two had the next highest atomic masses. Similar thinking was evident in answers to part (d) incorrectly stating that the metal seen in a flame test is the one with the highest atomic mass.

In part (e) few candidates used the term ‘quantitative’ when describing an advantage of mass spectrometry.

Question No.2

Part (a) required candidates to give an extended answer where they had to describe a sampling technique and explain how contamination could be avoided. This also illustrated the need for

candidates to read questions carefully as several answers explained how the dyes could be tested or latched onto testing the felt pens made from the dye. Neither aspect was required by the question and consequently did not gain credit. Candidates need to be more secure in their understanding of sampling techniques; very few indicated that small random samples would be taken from the dye containers or described the equipment they would use. Answers mainly referred to how contamination could be avoided although many seem to have a generic list rather than thinking through what is relevant to a chemical investigation so references to biohazards did not gain credit. Candidates need to think through the specific steps they would take regarding using clean equipment, specifying what they would actually use and how samples would be labelled with relevant information to clearly identify them. The other parts of the question referred to the process of chromatography and showed that candidates are confident regarding the experimental method but unclear regarding the principles.

Candidates were able to correctly locate the dye spot and find Rf values in parts (di) and (dii) although many answers in part (dii) did not refer to the experimental evidence which was the dye spots on the chromatography paper. There was a lack of understanding regarding the process, for example in part (b) the pencil line was often incorrectly labelled as the stationary phase and it was commonly wrongly thought that it would dissolve in the solvent in part (cii). Candidates did not appreciate in part (ciii) that the reason for the solvent reaching the top of the paper was to ensure the biggest spread of spots (so that subsequent measurement would be more precise). In part (civ) a few candidates were able to relate how a data sheet is used to identify dyes from their measured Rf values.

Question No.3

Most candidates were able to correctly identify at least the first two stages in using a microscope in part (a) but few showed an understanding of how to use the results to estimate a cell length in part (b) which was a more demanding question. Many seemed to simply refer to the 0.1mm scale which most incorrectly interpreted as covering 0.4mm rather than 0.3mm. Few candidates used the 0.1mm division to estimate cell lengths and consequently could not calculate a mean length. In part (b) no one knew that the cell length was estimated because it had not actually been measured, rather judged by eye.

Candidates were more familiar with the concept of a mean value. Part (c) was well answered but several candidates referred to an electron microscope having a ‘better zoom’ or focus rather than clearly stating the difference in the quality of the image.

Question No.4

Candidates were confident in interpreting the pH value in part (ai) but many did not appreciate the precision of the scale in part (aii) where answers needed to relate to all three aspects of the question. There was little understanding of the concept that indicator paper only uses a whole number scale so pH6 measured in this way includes the more precise pH6.2 given as the minimum pH for fish. Candidates need to realise that answers need to go beyond restating given information such as the pH range for snails; answers needed to indicate that the pH of the water was too low for snails to survive. In part (bii) the concept of results being reproducible was not well understood as many answers indicated confusion with the idea of reliability and no references were made to the use of standard procedures.

The reason for a trial titration in part (ci) was not clearly stated although candidates will have carried out this process in the laboratory.

Part (d) required candidates to give an extended answer where they had to calculate the mean and range from a short set of experimental results which included an outlier. The purpose of this was to provide an opportunity for candidates to identify the outlier and ignore it in their calculations and this was a feature of the best answers. However some of these better answers

still included the outlier in working out the range: it should be appreciated that it should be totally ignored as the result has been excluded. Most candidates' marks were limited because they did not recognise the outlier and included it in calculations. Better answers included interpretation of the graph to find the concentration but few candidates used this figure to comment on the change in water quality. Candidates should also have considered a comparison of the ranges of data on the two days as well as the range and indicated that the overlapping ranges meant there was uncertainty in any conclusion.

R075/02 How scientific data is used (Level 2)

General Comments

This examination provides candidates with opportunities to demonstrate their knowledge and understanding of the ways scientists obtain, analyse and communicate information using the context of the analytical techniques they have experienced in unit R704.

Centres need to be aware that this Level 2 paper is set at a standard equivalent to a higher GCSE paper, and thus they should enter their candidates for the most appropriate paper.

Question No.1

Candidates were, in general able to give the colour produced by copper in a flame, where students got this wrong they stated orange as the colour seen. Parts (aii) and (aiii), were very poorly answered. Candidates were not able to show an understanding of what made tests reproducible or repeatable.

In part (b) of question 1, candidates seemed to be confused between flame tests and the sodium hydroxide test referred to in the question, with many giving the result for copper in a flame rather than the result of the test with sodium hydroxide. Some scored a mark for understanding that the solution would go cloudy, very few knew that this was a precipitate. In part (ci) of question 1, candidates did not use the graph as the results, but instead used the table as the results and just stated other metals were present, many listed the five metals present in the table.

Question No.2

Many candidates found this question challenging. The majority of candidates read the question incorrectly and went on to give a method of how to test the dye using chromatography rather than how to choose and collect samples of the dye. Those candidates that did describe how to choose and collect the samples of dye, did not go on to explain the reasons for Nikhil's actions.

In question 2, part (bi) many candidates showed an understanding that a reference dye is used so that the sample can be compared to it. Part (bii) was less well answered, many thought that the pencil line would smudge or be ruined if the solvent went over it.

In part (ci), many candidates were able to calculate the Rf value. In some cases candidates lost marks as they did not use the formula given, but used a different, incorrect formula. Some candidates lost marks as they calculated the Rf value of the sample dye rather than the pure dye.

Question No.3

This question was not well answered. In part (a), the majority of candidates just stated that the microscope should be zoomed in or zoomed out. In part (b), candidates found it very hard to use the scale given to estimate the mean length of the cell, many thought that the scale represented 0.4 across as there were 4 lines and did not consider the cells that we being estimated.

Question No.4

In part (a) candidates were able to use some of the data to give a reason that they might agree with Miho. However, many stopped there and did not use all of the data to complete their reasoning.

In part (b), candidates were generally able to give either an advantage or a disadvantage of using a pH meter when compared to using universal indicator. Some candidates did not score as they misread the question and gave advantages and disadvantage of using universal indicator paper.

In part (ci) some candidates were able to state that the amount of water should be controlled. However, many thought that the amount of sodium hydroxide should be controlled, many misread the question and gave an answer relating to the sample being collected and stated that the lake water should be sampled at the same time of day or from the same point in the lake. Some candidates were able to answer question (cii) well and gave phenolphthalein with the correct reasoning, however, many that did state phenolphthalein did not give any reasoning with their answer so scored just one mark from the three available. Candidates showed a good understanding of how to calculate a range in question (ciii) and were able to see that the range was incorrect and how the mistake should be rectified. Part (civ) was less well answered, with very few candidates knowing how to calculate the percentage error.

The second six mark question of the paper, question 4(d), was poorly answered. The majority of candidates only read the end of the question stem and just stated that the concentration had decreased. Very few were able to give a description of how the colorimeter should be used.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Facsimile: 01223 552553

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